

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

Ex parte LEO MATHEW, BICH-YEN NGUYEN, MICHAEL SADD,  
and BRUCE E. WHITE

Appeal No. 2006-1350  
Application No. 10/074,732

ON BRIEF



Before HAIRSTON, BARRY, and BLANKENSHIP, Administrative Patent Judges.

BLANKENSHIP, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1, 2, 4, 5, 7-12, 14-21, 23-25, and 34.

We affirm.

## BACKGROUND

The invention relates to a method of forming a vertical double gate semiconductor device. Representative claim 1 is reproduced below.<sup>1</sup>

1. A method of forming a vertical double gate semiconductor device comprising:
  - providing a semiconductor substrate;
  - providing a first insulating layer over the semiconductor substrate;
  - providing a first semiconductor layer over the first insulating layer;
  - removing portions of the first semiconductor layer to form a semiconductor structure having a first sidewall and a second sidewall, wherein the first sidewall is opposite the second sidewall;
  - forming a second insulating layer adjacent the first sidewall and the second sidewall;
  - providing a second semiconductor layer over and adjacent the semiconductor structure, the second semiconductor layer being elevated in an area overlying the semiconductor structure and having a non-horizontal surface adjoining the semiconductor structure;
  - performing a first directional implant of a first conductivity type of the second semiconductor layer from a first predetermined direction;
  - performing a second directional implant of a second conductivity type opposite the first conductivity type of the second semiconductor layer from a second predetermined direction that differs from the first predetermined direction;
  - forming a conductive layer over the semiconductor structure and the second insulating layer; and

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<sup>1</sup> We observe that instant claim 14 purports to incorporate the limitations of claim 13, which has been canceled.

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removing a portion of the conductive layer and the second semiconductor layer to physically separate a first gate region and a second gate region, wherein:

the first gate region is adjacent the first sidewall of the semiconductor structure and has the first conductivity type; and

the second gate region is adjacent the second sidewall of the semiconductor structure and has the second conductivity type, the semiconductor structure preventing migration of doping species between the first gate region and the second gate region.

The examiner relies on the following references:

Forbes et al. (Forbes)	US 6,097,065	Aug. 1, 2000
Adkisson et al. (Adkisson)	US 6,472,258 B1	Oct. 29, 2002 (filed Nov. 13, 2000)
Fried et al. (Fried)	US 2003/0113970	Jun. 19, 2003 (filed Dec. 14, 2001)

Claims 1, 2, 4, 5, 7-12, 14, 16-21, 23-25, and 34 stand rejected under 35 U.S.C.

§ 103 as being unpatentable over Adkisson and Fried.

Claim 15 stands rejected under 35 U.S.C. § 103 as being unpatentable over Adkisson, Fried, and Forbes.

Claims 3, 6, 13, 22, and 26-33 have been canceled and claims 35 and 36 have been withdrawn from consideration.<sup>2</sup>

We refer to the Final Rejection (mailed Dec. 10, 2004) and the Examiner's Answer (mailed Sep. 22, 2005) for a statement of the examiner's position and to the

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<sup>2</sup> Although the purported status of claims 22 and 23 is inconsistent in the papers relating to the instant appeal, claim 23 is pending but claim 22 was canceled by an amendment filed June 9, 2004.

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Brief (filed Jun. 30, 2005) for appellants' position with respect to the claims which stand rejected.

OPINION

Based on appellants' arguments in the Brief, we will decide the appeal on the basis of representative claims 1, 17, and 15. See 37 CFR § 41.37(c)(1)(vii). Appellants advance numerous arguments in defense of the respective claimed subject matter. However, we find that the Answer sets forth a reasonable basis for *prima facie* unpatentability and is responsive to every argument presented by appellants, providing a reasoned analysis as to why the arguments are not deemed persuasive in view of the prior art that is applied. Accordingly, we will adopt the examiner's reasoning as our own in sustaining the rejections and add the following comments for emphasis. To the extent that any of appellants' remarks could be considered arguments for separate patentability of any claim other than 1, 17, or 15, we refer to the examiner's findings in the Answer in support of the rejection of the particular claim.

With respect to the basic combination of Adkisson and Fried as applied against instant claim 1, the examiner finds (Answer at 3-6) that Adkisson teaches essentially all that is required of the claim except for the steps of providing first and second directional implants. The finding of a motivation for providing the double doping process as described by Fried is based on the express teaching of Fried. Paragraph 7 of the reference teaches that asymmetric doping of a gate will shift threshold voltages to

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CMOS compatible levels in “planar double-gate devices as well as FinFETs.” The examiner further provides reasonable explanations as to why the artisan would appreciate that further limitations of the claim are described or suggested by the combined teachings of the references.

Appellants’ arguments in response to the rejections frequently note admitted deficiencies of each reference if considered alone. However, nonobviousness cannot be established by attacking references individually where the rejection is based upon the teachings of a combination of references. In re Merck & Co., 800 F.2d 1091, 1097, 231 USPQ 375, 380 (Fed. Cir. 1986) (citing In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981)).

Other of appellants’ arguments are moot in view of an apparent shift in the examiner’s position in the Answer. In the Final Rejection (at 12), the examiner held that the embodiment relied upon in Fried teaches formation of a double gate device. In the Answer (at 19), the examiner finds that the references are properly combinable even if, as appellants argue, Fried does not describe a double gate structure. Adkisson teaches a double gate structure, and the examiner finds there was motivation for applying the asymmetric doping taught by Fried regardless of whether Fried might teach a continuous (single) gate structure. We consider the examiner’s position in the Answer to be reasonable and unrebutted. Appellants were not unfairly prejudiced by

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the examiner's apparent change in position because appellants had the right to file a reply brief in response to the Answer, which they chose not to do.<sup>3</sup>

We are, further, not persuaded of error in the rejection of claims 17 and 15. With respect to dependent claim 15, subject to a separate rejection under § 103, appellants seem to submit that patentability can reside on the order of process steps, as demonstrated by the examiner's withdrawal from consideration of claims deemed to be patentably distinct from the claims before us on appeal. (Brief at 13.) However, the process steps of the claims withdrawn from consideration are different from those of instant claim 15. Moreover, appellants' remarks allege patentability based on annealing the first gate region and the second gate region before forming the metal layer; i.e., the timing of an anneal prior to depositing metal. Yet, appellants acknowledge (Brief at 12) but do not show error in the examiner's finding that Forbes teaches annealing a first gate region and a second electrode region prior to forming a metal. Nor do appellants demonstrate error in the application of Forbes' teachings to the double gate structure taught by Adkisson in view of the further teachings of Fried, as expressed in the rejection of base claim 1.

We therefore sustain the rejection of claims 1, 2, 4, 5, 7-12, 14, 16-21, 23-25, and 34 under 35 U.S.C. § 103 as being unpatentable over Adkisson and Fried and the

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<sup>3</sup> Moreover, appellants' arguments at page 8 of the Brief as to why the device of Fried cannot be considered to have a double gate structure appears to be inconsistent with appellants' specification at page 2, lines 11 and 12, which indicates the gate material of a two-gate transistor may be of the same material type and in continuous contact.

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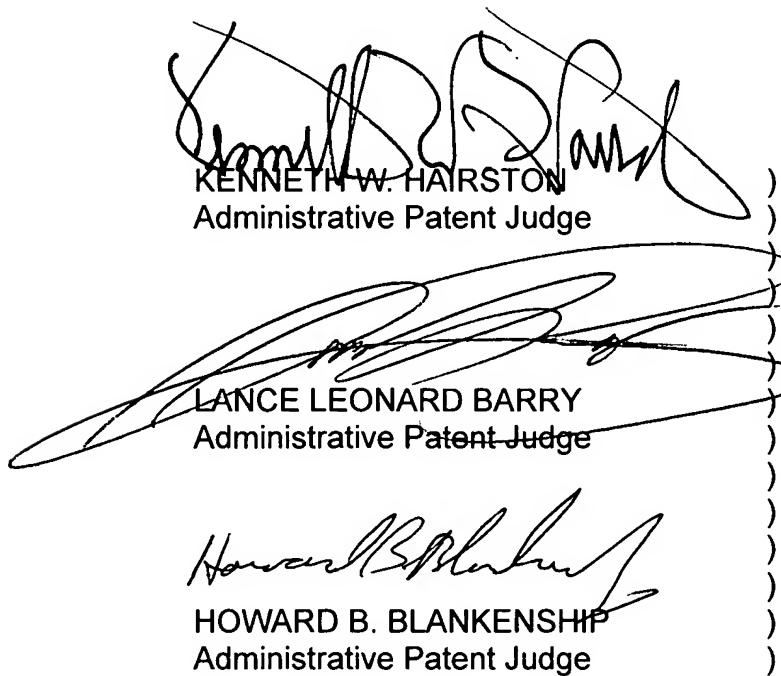
rejection of claim 15 under 35 U.S.C. § 103 as being unpatentable over Adkisson, Fried, and Forbes.

CONCLUSION

The rejection of claims 1, 2, 4, 5, 7-12, 14-21, 23-25, and 34 under 35 U.S.C. § 103 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a). See 37 CFR § 1.136(a)(1)(iv).

AFFIRMED

  
KENNETH W. HAIRSTON  
Administrative Patent Judge  
LANCE LEONARD BARRY  
Administrative Patent Judge  
HOWARD B. BLANKENSHIP  
Administrative Patent Judge  
BOARD OF PATENT  
APPEALS  
AND  
INTERFERENCES

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